

**Stable isotope ratios and dental health on the island of Lesvos, Greece: evidence for diet and lifeway.** S.J. GARVIE-LOK, Department of Archaeology, University of Calgary, Calgary, AB T2N 1N4, Canada.

Populations on the Greek island of Lesvos have historically had access to both terrestrial and marine resources. However, the relative degree of dependence on these in various periods and the impact of ethnicity on resource use have been unclear. This study examines diet and ethnicity in two archaeological populations, one late Byzantine (Christian) and one late Ottoman (Muslim), using stable isotope analysis of human bone collagen and the frequency of lesions of dental disease.

The stable carbon and nitrogen isotope ratios obtained for both populations suggest a diet primarily based on terrestrial resources. This may reflect customs favouring the consumption of meat and dairy products over that of fish. However, it may also reflect a preference for molluscs and small fish low on the food chain, whose stable isotope values depart less from terrestrial values than do those of marine organisms of higher trophic level.

The stable isotope ratios indicate little difference in dietary focus between Byzantine and Ottoman populations. Some difference is seen in the dental data, with the Ottoman population showing an increased prevalence of dental caries, antemortem tooth loss and periodontal disease. This may reflect an increased availability of refined carbohydrates in the later period.

The most marked difference between the two populations is in the distribution of stable isotope ratios. While values for the Byzantine population cluster tightly, the Ottoman population shows several individuals with extreme outlying values. Rather than reflecting higher dietary variability in the Ottoman period, this appears to indicate higher mobility, with some individuals coming into the community from elsewhere in the Ottoman empire.

These data improve our understanding of resource use in the Aegean in recent centuries. As well, they suggest increased residence mobility in Ottoman times, an idea that could be further examined using stable oxygen or strontium isotope analysis.

**Mutations, parental age, and offspring longevity: new ideas and findings.** L.A. GAVRILOV, N.S. GAVRILOVA, G.N. EVDOKUSHKINA and V.G. SEMYONOVA, Center on Aging, NORC and University of Chicago, Chicago, IL 60637.

Individuals born to older parents may suffer from the load of deleterious mutations. The human spontaneous mutation rate for DNA base substitutions is reported to be very high, presumably more than one new mutation per zygote (Crow, 1997, PNAS USA, 94: 8380-86). The mutation rate is much higher in male sperm cells than in female ovaries and increases with paternal age due to large number of cell divisions in the male germ line (Crow, 1997). In this study we have checked whether human longevity is affected by increased mutation load expected for the progeny of older

fathers. For this purpose the high quality data (more than 15,000 records) on European royal and noble families were collected, computerized and analyzed. The data on offspring lifespan were adjusted for historical trends and fluctuations in life expectancy of human birth cohorts. Also, in order to avoid bias in estimation of the offspring life span, only extinct cohorts were analyzed (born in 1800-1899).

We found (after controlling for maternal age at reproduction, paternal and maternal longevity and sex-specific cohort life expectancy) that adult daughters (30+ years) born to older fathers (45-55 years) live shorter lives and for each additional year of paternal age the daughters loose about  $0.5 \pm 0.2$  year of their life span. In contrast to daughters the sons are not significantly affected by delayed paternal parenting. This result was also confirmed after taking into account additional confounding variables (nationality, birth order, cause of death and loss of parents before age 20) using multiple regression on nominal variables. Since only daughters inherit paternal X-chromosome, this sex-specific life span shortening for daughters born to older fathers might indicate that genes affecting longevity and sensitive to mutation load are probably concentrated in X chromosome.

Another interesting finding is that familial resemblance between offspring and parental lifespan is higher for children born to younger parents as expected for genetic reasons (higher genetic diversity of younger parents). This study was supported by NIA grants P20 AG12857, AG13698-01 and AG16138-01A1.

**Mechanisms of familial transmission of human longevity.** N.S. GAVRILOVA, L.A. GAVRILOV, V.G. SEMYONOVA and G.N. EVDOKUSHKINA, Center on Aging, NORC and University of Chicago, Chicago, IL 60637.

Recent scientific debates on the future of human longevity and its possible biological limits has revealed a great need for direct biological evidence for such longevity limit if it really exists (Gavrilov, Gavrilova, 1998, *Science*, 281: 1611-1615). For this purpose the familial transmission of human longevity from parents to daughters (more than 4,000 cases for adult daughters born in 1800-1880) was studied, since daughters did not have high violent losses due to military service.

The familial transmission of human longevity from mother to daughter is essentially non-linear with very weak resemblance before maternal life span of 85 years (regression slope of daughters life span on maternal life span,  $b = 0.04 \pm 0.02$ ,  $n = 3,756$  cases,  $p = 0.05$ ) and very high additive heritability for longer lived mothers ( $b = 0.53 \pm 0.26$ ,  $n = 484$ ,  $p < 0.05$ ). This indicates that maternal age of 85 years could be considered as a demarcation line for women longevity. Women who live above this age are fundamentally (biologically?) different from other women in the sense that their daughters live significantly longer. Thus life expectancy at 85 years could be a biological limit for validity of extrapolative approach in forecasting of human life expectancy for women.

Similar study of familial transmission of human longevity

from *father* to daughter revealed a demarcation point at 80 years, suggesting that this age might represent a limit for validity of extrapolative approach to male life expectancy. The familial transmission of human longevity from father to daughter is also non-linear with very weak resemblance before paternal life span of 80 years ( $b = 0.03 \pm 0.02$ ,  $n = 3,842$ ,  $p = 0.18$ ) and very high additive heritability for longer lived fathers ( $b = 0.36 \pm 0.16$ ,  $n = 763$ ,  $p < 0.05$ ).

These results are also consistent with the predictions of evolutionary theory of aging and mutation accumulation theory in particular that the additive genetic variance for human life span should increase with parental longevity (Gavrilova et al., 1998, *Human Biology*, 70: 799-804). This study was supported by NIA grants P20 AG12857, AG13698-01 and AG16138-01A1.

Complex allometry of brain size scaling among mammals. B. R. GELVIN, California State University, Northridge, CA 91330. G. H. ALBRECHT, University of Southern California, Los Angeles, CA 90033, & J. M. A. MILLER, University of California, Los Angeles, CA 90095.

The relationship between brain size  $Y$  and body size  $X$  has long been described by the simple allometry equation:  $\log(Y) = \log(b) + k \cdot \log(X)$ . Early studies of mammals reported  $k \approx 0.67$ , presumably reflecting volume to surface area relationships (Bonin, '37; Jerison, '73). Later studies reported  $k \approx 0.75$ , presumably reflecting metabolic scaling (Martin, '81; Eisenberg, '81; Armstrong, '83; Hofman, '83; Worthy & Hickie, '86). Using Worthy & Hickie's data, Gelvin & Albrecht ('90) confirmed Count's ('47) long ignored observation of curvilinearity in logarithmic plots of brain weight versus body weight that can be fit by a 2° polynomial:  $\log(Y) = \log(b) + k_1 \cdot \log(X) + k_2 \cdot [\log(X)]^2$ .

We have assembled a new database of over 700 species of adult mammals. Brain weights (or volumes) and body weights were abstracted from primary literature sources. We used *Mammal Species of the World* (Wilson & Reeder, '93) to control and standardize taxonomy. For each species, we used the best available data taking into account sample sizes, sexual dimorphism, subspecific variation, and the origin (wild vs. captive) and condition (health) of specimens.

Our results from least-squares polynomial regression affirm that brain size scaling is best described by a curvilinear model rather than simple allometry. "Instantaneous allometry coefficients" — i.e., the slopes of tangents to the curved polynomial regression line analogous to the  $k$ 's of simple allometry — progressively decrease as body size increases. Simple allometry coefficients like  $k = 0.67$  or  $k = 0.75$ , as artifacts of an inadequate linear model, cannot be used to support hypotheses based on geometric or metabolic principles even though such factors must play some role in affecting the pattern of brain size differences among mammals. Furthermore, the common practice of using simple allometric regression to predict a species' brain size or calculate its encephalization quotient yields biased estimates, especially for small and large mammals.

Brain size scaling has neither a simple form nor a common explanation across the size range of mammals. Rather, the relationship of brain size to body size displays a complex allometric pattern that must have multifaceted explanations that vary both by body size and taxonomic grouping.

Cheaters never prosper: Social mechanisms maintaining honest signals of status in vervet monkey scrotal color.

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Previous experiments introducing pairs of unfamiliar adult male vervet monkeys (*Cercopithecus aethiops sabaeus*) matched for size, but differing in scrotal color, revealed that color conveys social status and predicts the potential for contact aggression to arise (Gerald, 1999). The present investigation examined interactions involving "mutant" "Cheaters", signaling high status. The purpose of this study was to estimate the costs and benefits of cheating, as a means to identify potential mechanisms maintaining color as an honest signal of status. Cheaters were Pale males, painted to resemble naturally Dark (dominant) males. Clear painted males served as Control subjects. Average rates of aggression (contact and non-contact), displays and affiliative behavior were calculated to assess potential costs and benefits of cheating.

Relative to Control males, Cheaters suffered fewer threats ( $U=26.5$ ,  $N_1=10$ ,  $N_2=13$ ,  $p=0.021$ ) and attacks ( $p=0.01$ ) from Pale males. Furthermore, Cheaters received more affiliative overtures from Pale males ( $U=26.5$ ,  $p=0.008$ ) than Controls. By contrast, Dark males threatened ( $U=22.5$ ,  $N_1=10$ ,  $N_2=10$ ,  $p=0.012$ ) and subjected Cheaters to more non-contact ( $U=22.5$ ,  $p=0.012$ ) and contact aggression ( $p=0.01$ ) than Control males. While Pale males interacted affiliatively, even more often with Cheaters ( $U=36.5$ ,  $p=0.000$ ) than with naturally Dark males, Dark males did not exhibit any evidence of distinguishing Cheaters from other naturally Dark males.

Evolutionarily stable strategy models of cooperative signaling demonstrate that when signaling benefits both the signaler and receiver, signals need not be costly for the maintenance of honest signals (i.e. Johnstone 1998). The results of these experiments suggest support for this model. While Cheaters may reap benefits from engaging in friendly interactions with Pale males, they increase their vulnerability to threats and aggression when interacting with Dark males. These costs of cheating may function to maintain honest signals of status. Other hypothetical costs and benefits will also be discussed.

Ontogenetic allometry of the skull. R.Z.GERMAN, Biological Sciences, University of Cincinnati, Cincinnati, OH 45221-0006

Charles Oxnard's use of complex statistical methods to examine the functional basis of both craniofacial and postcranial morphology transformed studies of allometry and scaling. His results, that sexual dimorphic allometry and scaling vary among structures within a set of taxa, suggests a particular course of investigation for ontogenetic studies of growth in mammalian skulls.

Variation in craniofacial skeletal morphology characterizes mammals and has a clear functional basis in demands of feeding. Yet all infant mammals

share a derived feeding behavior, suckling, and have a significant similarity in skull proportions. The adult differences between sexes and among species, then, are clearly the result of variation in growth as individuals mature.

To test the hypothesis that adult sexual dimorphism in the craniofacial skeletal variation is attributable to simple differences in growth trajectories, I have collected detailed longitudinal data for several species of different sized mammals, including *Mus*, *Rattus*, *Chinchilla*, *Oryctolagus*, *Monodelphis*, *Didelphis*. The data are from radiographs collected longitudinally from weaning through adult size. Nineteen craniofacial measurements taken from these x-rays were fit with a Gompertz nonlinear growth curve. The parameters of this curve describe the change in rate and duration of growth, and can be used to compare the relative growth of different skull regions for both sexes.

The results of these analyses suggest that differences between sexes in growth are consistent across species and that the differences among species are, with a few exceptions, a function of size differences and not shape differences. Variation in scaling among different regions of the skull, e.g. neurocranial vs viscerocranial is higher than variation between sexes or among species.

**Relative Reliability of Bones, Teeth and Soft-Tissues in Higher Primate Phylogenetics.** S. GIBBS (University of Liverpool, L69 3BX, UK), M. COLLARD (University College London, WC1E 6BT, UK) and B. A. WOOD (George Washington University, Washington DC 20052)

Are the different tissues that comprise the primate body (e.g. bone, dental enamel, muscle, blood vessels, etc.) equally useful for phylogenetic analysis? To our knowledge this question has never been formally addressed. To rectify this, we used cladistic methods to analyse characters drawn from the three categories of tissue.

A data set for extant hominoids was subdivided into dental-, bone- and soft tissue-based characters, and the resulting cladograms were compared with the well-supported consensus molecular cladogram for the hominoids (Ruvolo, 1997). The first data subset comprised 35 quantitative characters recorded on the dentition of *Gorilla*, *Homo*, *Pan*, *Pongo* and an outgroup (*Colobus*). The second consisted of 94 quantitative characters recorded on the crania of *Gorilla*, *Homo*, *Pan*, *Pongo* and an outgroup (*Colobus*). The third data subset comprised 200 qualitative soft-tissue characters collated from published records on *Gorilla*, *Homo*, *Pan*, *Pongo* and an outgroup (*Hylobates*). The dental and cranial characters were taken from Collard and Wood (*PNAS USA* [submitted]); the soft tissues characters from Gibbs (1999). The dental and cranial characters were size-corrected using one of the Mosimann family of shape ratios. They were then converted for phylogenetic reconstruction using divergence coding (Thorpe, 1984). The data subsets were subjected to parsimony analysis and bootstrapping using the phylogeny reconstruction package PAUP 3.0s (Swofford, 1991).

The most parsimonious cladograms and the bootstrap clades recovered in the dental and cranial analyses were not compatible with the hominoid consensus molecular cladogram. In contrast, the most parsimonious cladogram derived from the soft tissue characters had the same topology as the hominoid molecular cladogram, and the bootstrap clades were compatible with it (*Gorilla-Homo-Pan* 85%, *Homo-Pan* 92%). Thus, these results do not support the assumption that the different tissues of the primate body are equally useful for phylogenetic reconstruction. Phenotypic information about primate soft-tissues is apparently more useful for phylogenetic reconstruction than information from the two hard tissues that make up the higher primate fossil record. Possible reasons for this will be discussed. Supported by The Anatomical Society of Great Britain and Ireland (SG), The Wellcome Trust (MC), The Leverhulme Trust and The Henry Luce Foundation (BW).

**Microscopic documentation of bone modification.** W. H. GILBERT, Laboratory for Human Evolutionary Studies, Museum of Vertebrate Zoology, University of California, Berkeley, CA 94720-3140

Digital imaging technology has advanced substantially in recent years, improving our ability to diagnose and document modifications to bone and to discriminate among different agents of postmortem bone modification (e.g. cutmarks, percussion pits, carnivore gnaw marks). Hypotheses of hominid modification of bone are usually supported with accompanying photographs documenting diagnostic features. Historically, there have been two methods for acquiring such documentation: traditional light photography and scanning electron microscopy. In the past decade new digital image capture methods and image manipulation computer programs have been developed. Many of these vastly improve our ability to document and present modifications to bone.

Examples from the earliest hominid induced cutmarks (Hata Member, Bouri, Ethiopia) and from other Pleistocene contexts show how these digital tools can enhance understanding and presentation. Several methods for image capture are compared, and different techniques for digital image enhancement are evaluated.

Digital imaging not only brings the field to a methodological crossroads, but also has implications regarding the way in which the results of these methods might be archived and shared among colleagues via the internet. Digital technologies require serious attention to presentation issues surrounding image manipulation and warrant a reevaluation of traditional data presentation practices. Adobe Photoshop™ and many other programs allow the experienced user to enhance very subtle features of bone modification. Unfortunately, there are also a number of ways to digitally create nonexistent features. New standards should be considered that would document image manipulations and make them repeatable by others. Recent advances in image processing software are improving our ability to document bone damage and modification. With these new abilities come new challenges and responsibilities.

Planum temporale asymmetry in common chimpanzees: a reappraisal. E. GILISSEN, University of the Witwatersrand, Johannesburg, South Africa

In humans, the neuroanatomical planum temporale (PT) is a portion of Wernicke's area and plays an important role in auditory and linguistic functions. The PT has recently been identified in common chimpanzees and its interhemispheric surface area asymmetry has been evaluated in 3 independent studies (Gannon et al., 1998; Hopkins et al., 1998; Gilissen et al., 1998). As in humans, graded asymmetries of the PT are observed, with the left PT tending to be larger than the right in a majority of subjects.

Three relationships are possible between asymmetric brain structures. Asymmetry can result from (1) size increase of one side, (2) size decrease of the other side, (3) a combination of both (1) and (2). Based on 100 adult human cadaver brains, the study of Galaburda et al. (1987) suggested that structural changes away from symmetry involve size decrease of one side (e.g. right PT size) rather than size increase of the other (e.g. left PT size). In this case, asymmetry would correspond to a reduced state compared to symmetry and would imply a smaller (right+left) PT amount compared to symmetry. A more recent in vivo MR analysis of 221 normal human subjects (Jäncke et al., 1997) however shows no relationship between (right+left) PT amount and the degree of asymmetry and therefore suggests similar contributions of both sides to the strength of left-right PT asymmetry.

By combining data from the 3 above mentioned studies, I explored this issue on 37 adult common chimpanzees. The difference between left and right PT total surface area was determined by the asymmetry coefficient  $dPT = (R-L)/0.5(R+L)$  where negative values indicate left PT predominance and positive values right PT predominance. I found a negative, albeit non significant correlation between dPT and left PT size ( $r=-0.275$ ;  $p=0.09$ ), and a positive significant correlation between dPT and right PT size ( $r=0.379$ ;  $p=0.02$ ). There was no correlation at all between dPT and (left+right) PT size ( $r=0.004$ ;  $p=0.98$ ).

In agreement with the study of Jäncke et al. (1997), our data suggest that left-right PT asymmetry in common chimpanzees is the result of the production of both a smaller right and a larger left side. Nevertheless, the p values of the relationships between dPT and left and right PT size are strikingly different. More data are required to evaluate the relationship between dPT and left PT but this difference in p values suggests that size decrease of one side is a more important factor than size increase of the other in the strength of PT asymmetry. As a general result, PT asymmetry in common chimpanzees appears to be related to the same factors as in humans. Supported by a URC grant.

New dental remains of *Kenyapithecus africanus* from Maboko Island, Kenya support the congeneric status of *Kenyapithecus wickeri* and *K. africanus*. S.N. GITAU, B.R. BENEFIT, K.B. JOHNSON and M.L. McCROSSIN, Southern Illinois University, Carbondale, IL 62901.

Excavations at Maboko Island, Kenya between 1987 and 1997 resulted in the discovery of 270 dentognathic specimens of *Kenyapithecus africanus* representing all teeth except di. Within the sample, a significant degree of sexual dimorphism in size and morphology is documented for  $C^1$  (N=11),  $P^3$  (N=9),  $P^4$  (N=16),  $C_1$  (N=13), and  $P_4$  (N=13). Levels of canine sexual dimorphism in *K. africanus* are comparable to that of *Pan* and lower than that

of *Gorilla*, male  $C^1$ s being 130% as long, 124% as wide and 163% as tall as female canines, and male  $C_1$ s 129% as long, 132% as wide and 154% as tall as their female counterparts. Female  $P^3$ s and  $P^4$ s are only 75% as long and as wide as those of male.

Unworn male lower canines of *K. africanus* from Maboko strongly resemble KNM-FT 28 in size and crown height:

	L	W	CH	L/W	CH/L
KNM-FT 28	13	9.3	20.4	139	157
KNM-MB 32348	12	8.45	20	142	167

Relative to length, crown height for male canines of both species fall within the taller end of the *Pan*, *Gorilla* and *Pongo* range, and well below that of extant gibbons and cercopithecoids. Known female upper canines of *Kenyapithecus* from Maboko and Fort Ternan are virtually identical in size, shape and morphology. Female  $P^3$ s from Maboko strongly match that in female Fort Ternan maxilla KNM-FT 46 in size, shape, development of occlusal transverse ridges and fissures, and lingual relief.

Recent confusion about the morphology of upper premolars and canines of *K. africanus* from the type site of Maboko seems to derive from inclusion of *Nacholapithecus kerioi* canines and premolars within the *K. africanus* hypodigm (Ward et al. 1999). Canines of the Nachola ape differ significantly from those of *Kenyapithecus* in being stout and robust like *Afropithecus*. Like *Afropithecus*, upper premolars of *Nacholapithecus* are broader relative to length and  $M^1$  width than those of either species of *Kenyapithecus*. It is unclear to which genus the Kipsaramon ape belongs.

**Morphological factors reflected in dental wear: the sinking of subsistence.** M. M. Glantz, University of Pennsylvania, Philadelphia, PA 19104

The extent and pattern of posterior dental wear is commonly used to infer the subsistence behaviors of past human groups. Molar wear characteristics, such as enamel pitting and the slope of the occlusal plane, are thought to reflect dietary constituents and consistency as well as the evolution of food acquisition and processing techniques. Recent research has suggested, however, that posterior dental wear patterns are relatively poor indicators of subsistence when mandibular morphology is considered (Glantz 1997). The present research further indicates that dental wear patterns are more reliable indicators of bite dynamics and craniofacial morphology than subsistence alone.

In order to test the hypothesis that posterior dental wear, specifically the slope of the occlusal plane, is a function of subsistence, mandibular and dental measurements were taken from a Levantine sample (n=300) comprised of recent Bedouin material and archaeological samples from Neolithic, Byzantine, Arab period, Natufian, and Mousterian sites. Similar measurements were taken from a second geographically diverse sample (n=180) that includes recent skeletal material. In addition, twenty-seven craniofacial variables and bite patterns were recorded from sample 2. Subsistence was determined for each sample on the basis of supporting archaeological data.

According to the intra-class correlation coefficient,



subsistence explains less than 18% of the variance in occlusal wear plane angles controlled by wear stage in samples 1 and 2. In order to address the large amount of unexplained variance, multivariate tests, ANOVAs and regression analysis, were performed. Results suggest that a complex relationship between dimensions of the cranial base and the mandible dictate the slope of the occlusal plane of the first lower molars. Bite classification may also be inferred from the pitch of the occlusal plane. These variables account for the central tendencies of occlusal wear plane angles within groups and provide a way by which the pattern of variation in dental wear between human groups may be explained. These results considerably diminish the significance of subsistence in dental wear patterning.

**Morphology and population density of mona monkeys (*Cercopithecus mona*) on the Gulf of Guinea islands of São Tomé and Príncipe.** M.E. GLENN, Department of Anthropology, Humboldt State University, Arcata, CA, 95521, K.J. BENSON and K.F. JENSEN, Windward Islands Research and Education Foundation, 11 East Main Street, Bayshore, NY 11706.

West-central African mona monkeys (*Cercopithecus mona*) were introduced to the Gulf of Guinea islands of São Tomé and Príncipe between 190 and 500 years ago. The monkeys have since become naturalized and now occupy most areas containing primary and secondary rainforest on both islands. Neither island population had been the focus of a study previous to our investigation. Introduced island populations such as these can provide models under which the effects of isolation and a reduced gene pool may be examined.

We conducted surveys from June through October 1998. Population density was determined using modified line transects. Morphological measurements were collected from monkey carcasses voluntarily supplied by local hunters.

Average population density on São Tomé is 18.75 monkeys/km<sup>2</sup> (SD=20.12, n=47) and 23.67 monkeys/km<sup>2</sup> (SD=21.39, n=10) on Príncipe. Adult monkeys are sexually dimorphic across all measurements. Males average 5.13 kg (SD=0.14, n=3) while females average 3.25 kg (SD=0.36, n=4).

Population density estimates on São Tomé and Príncipe are not significantly different from those reported for mainland African mona monkeys, and indicate that the monas have successfully adapted to both islands. Morphometrics for the São Tomé and Príncipe mona populations fall within the range of those reported for mainland African *C. mona*. However, additional morphometric data are needed from several populations of *C. mona* across their African range before conclusive comparisons may be made between the island and mainland populations.

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**Dental development and the life histories of primates.** L.R. GODFREY, Department of Anthropology, University of Massachusetts, Amherst, MA 01003, K.E. SAMONDS and W.L. JUNGERS, Department of Anatomical Sciences, SUNY at Stony Brook, NY 11794.

Across the Order Primates, the timing and sequence of dental eruption vary both on absolute and relative scales (i.e., vis-à-vis particular ages and particular life history landmarks such as age at weaning or age at sexual maturation). Whereas much has been written about the absolute timing of dental eruption in relation to body and brain size, the complexity of the variation in the relative timing of dental and life history landmarks, as well as the heterochronic decoupling of aspects of dental and overall somatic growth and development, remain poorly understood. Despite tight overall integration of dental eruption patterns, there are important differences in the timing of dental eruption among species of primates that are surprisingly uninformed by variation in body or brain size. Attempts to understand why dental eruption is relatively precocious in some clades and delayed in others must grapple with the influence of factors such as diet and phylogeny.

This presentation focuses on that complexity. For over 40 species of primates at selected absolute ages (four months, one year) and life history stages (weaning, female sexual maturation), we examine dental endowment (cheek teeth occlusal area) and precocity (number of postcanine teeth erupted) as percentages of species' mean adult values. This allows us to test directly alternative hypotheses regarding the influence of dietary and phylogenetic factors, as well as adult body and brain size, on dental developmental schedules. Certain patterns emerge. We show, for example, that when compared to their more frugivorous, like-sized relatives, folivorous strepsirrhines resemble folivorous anthropoids in exhibiting accelerated dental development on an absolute scale, relative to craniofacial growth, and relative to particular life history landmarks. Nevertheless, there are important ways in which, even within the Strepsirrhini or the Anthropoidea, alternative developmental strategies among like-sized species with similar diets are manifested.

**Application of bone microstructural analysis to the comparative study of primate functional adaptation and life history.** H.M. GOLDMAN, S.C. MCFARLIN, J.S. WARSHAW, F.S. SZALAY & T.G. BROMAGE. Hard Tissue Research Unit & Analytical Microscopy and Imaging Center in Anthropology, Dept. of Anthropology, Hunter College & The Graduate School of CUNY & NYCEP, New York, NY 10021.

Combined analyses of bone tissue composition at both micro and macro-structural levels can provide a more holistic understanding of comparative primate skeletal morphology, functional adaptation, and growth and development. Our research objectives are 1) to document intra-populational variation in the structural and material properties of bones for

samples of known sex and age; 2) to investigate the relationship between the micro-structure of developing bone and organismal life history; 3) to examine the nature of relationships among the structural-functional properties of bone tissues and skeletons, and their expression in specific lineages.

By using broadly comparative samples of primate and non-primate mammalian skeletons, in combination with focused primate population samples (including humans) of known provenience (*i.e.* including individuals of known sex, mechanical adaptation and life-history), we are able to address issues of inter and intra-specific and population variability. Our research focuses on a variety of properties of bone which reflect shape, distribution, quantity and orientation of structures. Variables include: cross-sectional geometry; distribution of tissue types; lamellar organization, density (reflecting both porosity and mineralization) and preferred collagen fiber orientations.

In order to correlate information obtained from different imaging modes, we have developed unique methodologies for both preparation and imaging of bone specimens that allow us to analyze histological sections by both light and scanning electron microscopy (Goldman *et al.*, 1999). In addition, we have developed free-standing Windows based programs to facilitate automated quantification of microstructural properties across whole cross-sections. These methods provide the means to explore interactions between a wide variety of macro- and microstructural variables at a level previously not possible.

We will present preliminary data from ongoing laboratory projects to demonstrate the potential of this comparative approach. In addition, we will discuss future applications of these methods to paleontological and archaeological samples.

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Effects of ecotourism on the behavioral ecology of Bwindi gorillas, Uganda: preliminary results. M.L. GOLDSMITH, Department of Environmental and Population Health, Tufts University School of Veterinary Medicine, N. Grafton, MA 01536.

Recently, much attention has been given to the impacts of ecotourism on mountain gorilla survival in East Africa. Most studies summarize both the benefits (economic gains, and increased habitat and gorilla protection) and costs (changes in gorilla behavior, stress levels, and disease) of this fast growing global industry. In most cases, costs are assumed or supported with only anecdotal evidence.

The purpose of this study is to examine the effects of ecotourism on the behavioral ecology of Bwindi's tourist gorilla population. The goal is to determine if dietary, ranging, and grouping patterns of tourist gorillas differ from 'wild' populations and what health implications, if any, these differences may have.

Preliminary data were collected on three gorilla tourist groups in Bwindi during October 1998 – January 1999, and I have collected similar data on these groups intermittently since 1996. The most interesting result is that tourist gorilla groups spend a significant amount of time outside the National Park boundary. For example,

36 consecutive all-day follows and GPS recordings of nest sites showed that one tourist gorilla group slept within the park boundary only once. When outside the park, their diet is more herbaceous and includes domestic and wild banana plants, as well as other crops. While in these agricultural areas, tourist gorilla groups greatly reduce the distance they travel each day. Most intriguing, gorilla groups change their ranging patterns and concentrate their activities within particular areas outside the park. In one case, a group nested within a 200 m<sup>2</sup> area for six repeated nights making short forays into the surrounding agricultural land during the day.

These behavioral changes can have potentially serious health effects such as increased muscle atrophy and obesity from reduced day ranges, and increased rates of disease transmission and higher parasite loads from the continued re-use of small areas. Further investigation on how tourism effects behavioral ecology and influences gorilla health is necessary to better manage and preserve this highly endangered subspecies.

A preliminary study of the female copulation call in long-tailed macaques (*Macaca fascicularis*): testing current hypotheses. G.R. GOLDSTEIN<sup>1</sup>, A. FUENTES<sup>1</sup>, K.G. SUARYANA<sup>2</sup>, and I.D.K. HARYA PURTA<sup>2</sup>, <sup>1</sup>Department of Anthropology Central Washington University, WA 98926 and <sup>2</sup>Universitas Udayana Primate Research Center, Bali, Indonesia.

Researchers have suggested that the female copulation call in non-human primates may function as a signal to the mating male to ejaculate or serve to reduce harassment of the caller by other females. Others have suggested that the call may serve to alert a dominant male who in turn displaces subordinates. Most recently, researchers have proposed that the female copulation call may serve as a signal to males other than the mating partner.

To date little is published about the behaviors surrounding the female copulation call of long-tailed macaques (*Macaca fascicularis*). The goal of this poster is to present and analyze both male and female behaviors that occur during and/or after the female copulation call in 3 troops of long-tailed macaques.

Data were collected at the Padangtegal Monkey Forest in Bali, Indonesia. In 120 copulations, involving 13 males and 15 females, behavioral patterns surrounding the female copulation call were collected and scored in one of six categories. Percentages of behaviors are given with and without the copulation call present. Results from this study demonstrate that males ejaculated significantly more when females called ( $\chi^2$  [df=1] = 32.013,  $p < .0001$ ), and that females called more with adult males ( $\chi^2$  [df=1] = 6.818,  $p < .0090$ ) than subadults. Spearman's Rank Correlation shows a significant correlation (Spearman's rank order [N=3]  $r = +1.00$ ,  $p < .0001$ ) between rank and calls in Troop 3, but no correlation in Troop 2.

The impact of human growth and development on the age and sex distributions of children in paleodemography. S. K. GOODE-NULL, Department of Anthropology, UNIVERSITY OF MASSACHUSETTS, Amherst, MA 01003.

The paleodemography debate of the 1980's highlights many issues that were and are central to demographic reconstructions of archaeologically recovered human populations. At the crux of the debate is the assertion that the very methods utilized by physical anthropologists to assess age of human skeletons are problematic. While this debate continues to be revisited, it is interesting to note that the arguments on both sides revolve primarily around adult segments of the population. The emphasis on adults is partially dictated by several limiting factors, chief among which are under-enumeration of infants and children, and a lack of reliable sexing techniques for infant and juvenile remains.

Aging criteria for juvenile remains have generally been considered to be reliable. However, more recently the appropriateness of these standards has also been called into question (Lampl and Johnston 1996). This paper will therefore: 1) discuss and evaluate some of the problems with juvenile aging and sexing techniques, and 2) investigate the repercussions that inaccurate age assessments and sex assessments of children have on the construction and interpretation of paleodemographic lifetables.

A review of juvenile aging methods indicate a need to follow the same standard protocol, of assessing sex prior to assigning age, that is employed for adults. Such a practice if coupled with adjusting the standards to meet the conditions of a population, will drastically reduce the problems of over- or under-estimating ages of infants and children in archaeologically recovered populations. In turn the construction and interpretations of paleodemographic lifetables will be enhanced.

Chemical analyses of the places of birth and migration of the Africans of Colonial New York. A.H. GOODMAN<sup>1,2</sup>, J.R. REID<sup>1</sup>, M.E. MACK<sup>3</sup>, J. JONES<sup>2,3</sup>, C. SPAULDING<sup>1</sup>, S. KEYDEL<sup>1</sup>, R-J. SONG<sup>2</sup>, D. AMARASIRIWARDENA<sup>1</sup>, and M.L. BLAKEY<sup>3</sup>. <sup>1</sup>Natural Science, Hampshire College, Amherst, MA 01002; <sup>2</sup>University of Massachusetts, Amherst, MA 01003; <sup>3</sup>Howard University, Washington, D.C. 20059.

Where did enslaved Africans grow up? Were they born into slavery or did they spend their early lives free in Africa? Answering these questions is of great public interest. The answers will also help to better understand the stresses of slavery. The focus of this paper is on reconstructing patterns of migration of individuals from the New York African Burial Ground. Our goals are to better understand: (1) region of birth of individuals, and (2) individual's ages at enslavement and arrival in New York.

To answer the above questions we are employing a

multiple indicators approach based on chemical analyses of bones and teeth that calcify at birth and in later years. Methods of analysis include elemental signature analysis (ESA) and the analysis of isotope ratios of lead, strontium and oxygen. Each method is sensitive to different aspects of the environment. Laser ablation analysis of elements is being employed to provide a chronology of chemical change within teeth. Comparisons within and among teeth and among individuals can indicate changes in environment/location during tooth development.

Results from first and third molar enamel crown variation in ESA and the <sup>87</sup>Sr/<sup>86</sup>Sr isotope ratio show that some individuals are residentially stable and others changed residence more than once. For example, an individual with notched incisors, an African cultural trait, has the highest <sup>87</sup>Sr/<sup>86</sup>Sr isotope ratio of all first molars analyzed (0.718813) and an even higher third molar isotope ratio (0.721038), indicating at least one residence change before coming to New York after ca 12 years of age. The use of additional methods should further refine our knowledge of the age of individuals at forced migration and the location of their natal homes.

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Noncoding DNA evolution in primates. M. GOODMAN, S. PAGE, C.M. MEIRELES, J. CZELUSNIAK, and C. CHIU, Wayne State University School of Medicine, Detroit, MI 48201

To reconstruct the course of phylogenetic branching during primate evolution we used DNA evidence from noncoding sequences of nuclear genomes of 65 primate species representing 41 of the 60 recognized extant primate genera and almost all primate clades with ages older than that of genera. The evidence from different loci (e.g.  $\beta$ -globin gene cluster, albumin introns) were in the main congruent with each other and with extant and fossil osteological evidence. A phylogenetic classification of primates based on this cladistic evidence and estimates of branching times by the model of local model clocks divides Primates into Haplorhini and Strepsirhini, Haplorhini into Tarsiiformes and Anthroipoidea, and Strepsirhini into Lemuriformes and Loriformes. Anthroipoidea divides into Platyrrhini and Catarrhini, and the latter into Cercopithecidae and Hominidae. Using the principle of age equivalence to assign taxonomic ranks to the various primate clades (i.e. clades of roughly equivalent age assigned the same taxonomic rank) places all living apes and humans within Homininae, divides Homininae into Hylobatini (common and siamang gibbons) and Hominini and the latter into Pongina for *Pongo* (orangutans) and Hominina for *Gorilla* and *Homo*. *Homo* itself divides into subgenera *H. (Homo)* for humans and *H. (Pan)* for common and bonobo chimpanzees.

This objective, non-biased view of humankind's place in primate phylogeny provided a framework for assessing the genetic processes that have operated in the evolution of primate genomes. Notably, rates of selectively neutral nucleotide substitutions show considerable variation

between primate lineages, being almost twice as fast in loriforms than in lemuriiforms and being several times faster in stem-Anthropoidea than in later platyrrhines and catarrhines, hominids showing the slowest rates. Also among cercopithecids and atelids, omnivores and fruit eaters compared to leaf eaters have larger brains, longer life-spans, and slower rates of noncoding DNA evolution. Possibly life-history strategies that favor intelligence and longer life-spans also select for decreases in *denovo* mutation rates. Supported by NSF and NIH grants.

Sex-appropriate estimators of body mass. A.D. GORDON, Department of Anthropology, University of Texas, Austin, TX 78712-1086.

The number and types of techniques which are used to estimate body mass for a particular specimen are often limited by incomplete preservation of skeletal material. In cases where several skeletal elements from an individual are recovered, it is fairly commonplace to generate a range of estimated body masses using all available techniques. A better method is to determine which techniques are better predictors than others for a given situation and to give the resulting estimates preference over all others.

In particular, special attention should be paid to intraspecific variation. Sex-specific allometries exist, and predictive equations based on exclusively male or exclusively female samples have been used to generate sex-specific body mass predictions. At least as importantly, the difference in goodness of fit of regressions between particular skeletal measures and body mass for males and females can be used to determine which particular techniques are the best predictors of body mass *for that particular sex*. This approach is only usable when sex identification is possible and sex-specific predictive equations based on good analog taxa are available.

The present study analyzed the relationship between articular surface areas and body mass for 10 female and 14 male wild-caught savanna baboons (*Papio cynocephalus* ssp.) Measurements of the femoral head surface area (FHSA) and humeral head surface area (HHSA) for each individual were made by digitizing each sample with a 3-D laser scanner. Each digitized image was then used to calculate the area of the articular surface. The body mass of each individual had been recorded at the time of death, allowing for accurate regressions of articular surface area against body mass. In this case, prediction errors are minimized when body mass is estimated from HHSA for females and from FHSA for males.

It is important to recognize that sex-specific allometries are important not only in generating sex-specific predictive equations, but also in determining which are the most accurate estimates to use – and to realize that the most accurate estimation techniques may not necessarily be the same for males and females.

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**Unusual non-occlusal dental wear facets in prehistoric Sudanese.** K.D. GORDON, Dept. of Anthropology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560, and A. COPPA, Dipartimento B.A.U., Sez. Antropologia, Università "La Sapienza," 00185 Roma, Italy.

A sample of more than 100 individuals has been recovered from a necropolis at Geili, Sudan, spanning Late Neolithic through Meroitic and Christian periods. An extraordinary pattern of wear on buccal and lingual surfaces has been observed in dentitions of a small sub-set of the sample. The wear presents as smooth, concave facets, frequently exposing dentine, and usually confluent over several adjacent teeth. These facets have been found on all tooth types, on both sides, and in both jaws, although posterior and mandibular teeth are most likely to be affected. While the buccal surface wear is more common, some individuals show extensive faceting on the lingual surfaces of teeth as well. In addition, some of the affected dentitions also exhibit inter-proximal grooves like those usually attributed to use of tooth picks to probe or clean inter-proximal spaces.

SEM examination of buccal facets has revealed striations indicating that the axis of the wear-producing activity was parallel to the mesial-distal axis of the tooth-row. Lingual surface striae are more oblique, consistent with the more limited range of access to these surfaces. That the activity was performed on several teeth simultaneously is shown by the existence of congruent facets on several adjacent teeth, showing the same orientation of striae and surface curvature. The inter-proximal grooves typically exhibit striae perpendicular to the mesio-distal axis of the tooth row.

Causes of this overall wear pattern are uncertain. Various possibilities are evaluated in the light of SEM results and regional distribution of facets throughout the dentition. Frequencies of other oral pathologies suggest that those individuals showing unusual wear facets and I-P grooves have greater alveolar resorption and more abscesses than non-affected individuals. This suggests that the activities producing these different types of non-occlusal wear may all have been palliative in nature, perhaps in response to chronic gingival irritation.

A comparison of male scent-marking behavior in two species of Lemnidae. L. GOULD, University of Victoria, Victoria, BC V8W-3P5 & D.J. OVERDORFF, University of Texas, Austin 78712

Scent-marking and olfactory communication are used extensively in prosimians, and can provide spatial and temporal records of group movement and behavior. Here, we compare rates of male scent-marking behavior in relation to reproductive seasons in two related prosimians: *Lemur catta* and *Eulemur fulvus rufus*. Both species live in multimale groups characterized by strict



reproductive seasonality, but live in vastly different habitats. Scent-marking data were collected on adult male *L. catta* at Beza-Mahafaly Reserve, and *E. frufus* at Ranomafana National Park, Madagascar. In *L. catta*, rates of scent marking differed significantly by reproductive season, with higher rates occurring in mating and lactation/migration periods. In *E. frufus* no seasonal differences in scent marking rates occurred. Dominance rank of *L. catta* males did not affect rates of scent marking. In *E. frufus*, clear dominance relations were not apparent, however, 2 of the 5 males studied scent-marked more in the mating season, and also experienced greater mating success. In *L. catta*, higher rates of scent marking in the mating season may relate to indirect reproductive competition during a period of high aggression, while such aggression/mating competition was not as marked in *E. frufus*. Furthermore, higher rates of marking in resident *L. catta* males during lactation/migration may correlate with vigilance toward immigrating males, while there is no clear male migration season in *E. frufus* at Ranomafana. Effects of interspecific habitat differences will also be addressed.

Behavioral and morphological investigation of hand laterality in colobine monkeys. A. E. GRAFF and J. RUNESTAD CONNOR, Department of Biological Sciences, Western Illinois University, Macomb, IL 61455.

African colobus monkeys differ from other colobine monkeys in having vestigial thumbs. In this study, the presence or absence of functional thumbs in colobine monkeys is investigated as a potential factor related to laterality of hand use. Evidence for laterality in colobine monkeys is explored using ethological study of zoo animals and metacarpal radiographs of wildshot museum specimens.

Behavioral observations of hand use by *Colobus guereza* and *Trachypithecus obscurus* were conducted. Paired sample t-tests indicate that both species use one hand significantly more often than both hands for several activities. When paired sample t-tests comparing frequencies of left versus right hand use for the one-handed activities were performed, however, no individuals of either species showed hand preference.

Radiographs of hands for both species were taken, and measurements from the x-rays were used to calculate metacarpal cortical thickness. For both species, there are no significant differences between cortical thickness of metacarpals on the left hand versus those on the right, or among metacarpals on the same hand (paired sample t-tests). Cluster analyses combining data

for the two species indicate that the species overlap heavily in cortical area, but do differ in length of the first metacarpal relative to the second metacarpal for one hand. Small and large *C. guereza* have first metacarpals similar in length.

In summary, this study finds little evidence of either behavioral or morphological hand laterality in either species of colobine monkeys considered. The short first metacarpal of *C. guereza* is the only result related to thumb reduction.

Variability in habitat, diet, and social structure of *Haploleirus griseus griseus*. C. Grassi. The University of Texas-Austin

This study evaluates the effects of habitat disturbance on the ecology of *H. griseus* at Ranomafana National Park in Southeastern Madagascar. The two main study areas within the park differ in altitude, degree of habitat disturbance, forest composition, and primate fauna, yet are only 5 km apart. For one year I studied three groups of *H. griseus*: two at Vatoharanana (higher altitude, less disturbed, *Varecia* present, *H. aureus* and *H. simus* absent) and one at Talataky (Varecia absent, *H. aureus* and *H. simus* present). Full-day focal animal observations and all-occurrence data of feeding bouts were recorded (duration, species, part). All statistical analyses are  $\chi^2$  tests based on the percent of time each group spent feeding on a particular plant part or species. I predicted that feeding ecology would differ between the two sites due to habitat differences, but I had made no such predictions for social structure.

There were significant differences in the diets both between groups at Vatoharanana (V1 and V2) and between sites. V1 ingested more non-bamboo folivorous materials, specifically new and mature leaves, than V2 ( $p < .01$ ). V2 ate significantly more bamboo than V1 ( $p < .05$ ). In contrast, the Talataky group (T) ingested more fruit than either V1 or V2 ( $p < .01$ ). This is due mostly to the preference for ripe fruit, in particular guava ( $p < .01$ ) of T. Furthermore, the different groups favored different species of bamboo. T ingested more of the small-leaf variety of the tsongolovolo mena vine bamboo ( $p < .01$ ) than either V1 or V2. V1 ingested more volotsangana (*Cephalostachyum cf. perrieri*) ( $p < .01$ ) which is not found within V2's home range or at Tala. In contrast, V2 favored volofitokafo (spider bamboo) ( $p < .01$ ).

The differences in the diets of these three groups of *H. griseus* can be attributed to resources available in their home range. Many plant species that T ate were not present at Vato (e.g. guava) and vice versa (e.g. volotsangana). Also, the abundance of plants may vary between areas. V1 and V2 had very different home range qualities and therefore different diets despite the fact that both occur at Vato. These habitat differences may also impact group size and mating system as well. Talataky has both larger group sizes and a higher density of *H. griseus*. These larger groups are clearly not monogamous as some of the early literature on *H. griseus* reports. Due to a better quality diet including more fruit, and their apparent dietary flexibility, *H. griseus* is able to not only survive and actually increase in number in disturbed areas, but also alter their social structure based on resource availability.

Poverty and immigration in a city of change: archival and skeletal analyses of the Dunning Poorhouse, Chicago. A. L. GRAUER, Department of Sociology and Anthropology, Loyola University of Chicago, Chicago, IL 60626, E. M. MCNAMARA, Department of Anthropology, University of Illinois, Urbana-Champaign, IL, and S. B. HANSON, Biological Anthropology Laboratory, Loyola University Chicago, Chicago, IL.

The population of the city of Chicago and Cook County grew from 30,000 to 300,000 inhabitants between 1850 and 1870. During these decades the population of the Cook County poorhouse (Dunning) doubled. Using archival and human skeletal data the lives of the city's poor is explored.

Census data from 1860 indicate that of the 200 residents at the Dunning Poorhouse 79.5% were paupers and 17.5% were classified as insane. 41.5% of the residents were women, and 17% were children under the age of 15. 60% of all paupers were Irish immigrants. By 1870 the census reports 424 residents in the facility, 66% paupers and 34% insane. 39% of the residents were women, and 8.7% were children. 41% of all residents were Irish immigrants.

The skeletal data (n=120) from the Dunning Poorhouse cemetery (ca. 1851-1869) indicates that 34.9% of the population were under 15 years old, 29.2% died between the ages of 15-25 years old, and 35.9% died over the age of 25. 56% of the population were female, 44% were male. Skeletal indicators of stress were commonly found in the adult specimens, with periosteal reaction present in 25% of population, linear enamel hypoplasias present in 36.7% of the population, caries present in 50% of the population, and trauma recognizable in 23% of the adults.

These data are examined alongside historical documentation concerning the growth and development of the city of Chicago, and are compared to other poorhouse samples from North America in order to gain further insight into the lives of Chicago's poor.

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Distinguishing human from non-human ribs using external morphology. A. A. GRAY, Department of Anthropology, University of California, Riverside, CA 92521

Skeletal analysis in the archaeological or forensic setting sometimes involves human skeletal remains which are highly fragmented or commingled with non-human remains, particularly in wilderness or rural areas. In these situations, it can be difficult to distinguish human from non-human remains. When resources allow, discrimination can be obtained using DNA and other laboratory-based methods. Often, those resources, particularly time and money, are not available. Then the initial examination must take place *in situ*.

Ribs can be especially difficult to distinguish between

humans and non-humans. In particular, the ribs of deer can be challenging to distinguish from human bone. The goal of this research was to develop a speedy, reliable, morphology-based field technique for determining if skeletal rib remains are human or non-human based on examining the morphology of the neck portion of the rib.

Humans have an intercostal groove on the inferior side of the rib while other mammals examined have an additional intercostal groove on the superior side as well, in varying degrees of depth. To facilitate the procedure for those with little faunal osteological experience, an illustrated key was developed. This technique can be employed by archaeologists and physical anthropologists to quickly ascertain the status of questioned rib remains without additional equipment or resource requirements.

Reproductive histories and life history of Bokora and Matheniko Karimojong women of northeast Uganda. S. J. GRAY, Dept. of Anthropology, University of Kansas, Lawrence, KS 66045. H. A. AKOL, Moroto, Uganda.

From August, 1998, through March, 1999, we collected reproductive histories for 300 Karimojong women, from 4 agropastoral clusters in Moroto District (Karamoja), Uganda. Women aged 21 to 70 or more years, who had been part of a sexual union for at least 1 year, were included in the sample. The research was part of a baseline study of Karimojong fertility and its determinants.

Women were asked to provide information about the timing of all reproductive events: menarche, entry into their first sexual union and all subsequent unions, first pregnancy, first childbirth, and all subsequent pregnancies (women also supplied information on pregnancy outcomes). Post-reproductive women were asked to estimate the year of their last pregnancy, last childbirth, and last menstruation. For each woman, we also collected data about the duration of sexual unions, the reason for their termination (if applicable), and whether the woman was an "official" or unmarried wife. In cases of polygynous unions, we asked if the woman was the first or a higher-order wife and how many co-wives she had.

Our preliminary analysis suggests that menarche of Karimojong women in this sample occurred in their late teens, and entry into a sexual union occurred within two years of that event. In the case of first unions in which bridewealth was paid at the onset, girls not infrequently were married before menarche, to men at least 10 years their senior. First unions more often were informal, however, and most women gave birth to their first child outside of a formal marriage. Divorce and widowhood were common.

Women experienced first pregnancy and first livebirth in their early 20s. A conservative estimate of completed gravidity is 10 pregnancies, but parity may be 6 or lower. Among post-reproductive women, menopause occurred between age 40-50 years, but last childbirth was somewhat earlier. Multiple determinants of early cessation of reproduction include spousal death, child deaths, termination of unions, polygyny, and secondary sterility. Significant inter-generational and inter-cluster variation in the reproductive experience of the women in this study is predicted.

The life history of Karimojong women parallels that of neighboring Turkana pastoralists, who are closely related to the Karimojong. However, marked differences, particularly in relation to the instability of Karimojong unions, illuminate the effects of economic, cultural, and environmental change in Karamoja in recent decades.

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A theoretical estimate of the location of the anterior incisor in primates. W.S. GREAVES, Oral Biology, Univ. of Illinois at Chicago, Chicago, IL 60612.

The students pursuing functional and morphological studies at the U of Chicago had a variety of interests, but we were all strongly influenced by Charles Oxnard's important anatomical studies. Even though my interests remain with the masticatory apparatus, I continue to benefit from his example. In this study of the mechanics of primate jaws, the posterior resultant vector of jaw muscle force is emphasized. Here it is accepted that important distances in the skull and lower jaw are as short as possible to limit the amount of bone used. Of the possible posterior muscle vectors, only one is defined by minimum distances, has a maximum moment, and approximately the same inclination as vectors estimated from dissections of the jaw muscles.

Combined with earlier theoretical work, a similar assumption has been used to estimate the location of the anterior upper incisor by minimizing its distance to the joint and to the head of the muscle vector. Most of the incisor locations in two large samples of primate skulls approximately match the predicted positions. In addition to potentially providing a mechanical explanation for the location of the incisor as well as other mechanically relevant features, this approach also offers a means of inferring the locations of anatomical structures in partial skulls.

This result can also be viewed from a different point of view. The predicted location of the incisor varies with the inclination of the vector. Therefore, a correct prediction of the location of the incisor implies that the vector's estimated inclination is also correct.

Analysis of Cremated Human Remains from an Early Archaic Mortuary site in Southern Indiana. T. R. Greene and C. W. Schmidt. Archeology and Forensics Laboratory, University of Indianapolis, Indianapolis, IN 46227

Cremated skeletal remains from the Early Archaic Jerger site represent some of the oldest human remains ever found in Indiana. They were recovered from five burial pits (that were not the original crematories) and were accompanied by chert flakes and faunal remains.

Osteological study commenced in order to address the following questions: How intensive was the cremation effort? Were the individuals burned with soft tissues present? How many individuals were in each pit? Were the remains segregated by age? Were the remains of a single individual present within more than one pit?

The methods used for this analysis followed guidelines for cremation study outlined by Buikstra and Ubelaker (1994) as well as those provided by Symes and colleagues for the study of cremations in forensic contexts. The heat-related variables that we scored for each fragment included:

color, fracture pattern, warpage, and delamination. Other variables were fragment size, non-heat-related fractures, and cultural modifications.

Although the average fragment size was only 1.3 cm, we were able to address all of the above questions. Eighty-eight percent of the fragments showed calcinization while only 5 % were not burned, suggesting that a thorough burning of the remains was sought. These percentages are consistent for cranial and post-cranial elements (axial and appendicular fragments are present throughout). Fifty-five percent of the cranial fragments showed evidence of delamination, suggesting that at least some of the remains had soft tissues present at the time of burning. Of the three pits that have so far been completely studied, a total of 5 individuals have been found, suggesting that each pit does not represent a single interment. Since erupted, adult third molars and deciduous teeth have been found in the same pit, it is clear that the pits were not age-segregated. Moreover, teeth from a single individual were found in two separate pits. No evidence of non-heat related fracture or cultural modification was found.

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Reiter's syndrome in a prehistoric burial from southern Indiana. M.C. GRIFFIN, San Francisco State University, San Francisco, CA 94132, R.M. KNOLL, Moorhead State University, Moorhead, MN 56560.

Spondyloarthropathy is a "subset of arthritis, characterized by erosive joint disease, ossification of sites of tendon, ligament, and joint capsule insertion (enthesial bone formation), and a tendency to spine and sacroiliac fusion" (Rothschild and Woods, 1991; Resnick and Niwayama, 1995). Clinically, spondyloarthropathy is separated into ankylosing spondylitis, Reiter's syndrome, psoriatic arthritis (arthritis of inflammatory bowel disease), and "undifferentiated spondyloarthropathy" (Rothschild and Woods, 1991).

A pattern of erosive joint changes consistent with a diagnosis of spondyloarthropathy (erosive arthritis) was noted on the postcranial skeleton of a male burial from the Kocher site in southern Indiana. Although present at virtually all of the joints, the most noticeable alterations involved erosive pitting around the joint capsule insertion of the shoulders and knees, pitting on the distal metacarpals and metatarsals, and pitting on the vertebra. Also observed was the formation of proliferative enthesial bone and syndesmophytes on the lumbar vertebrae. A diagnosis of spondyloarthropathy was favored over one of rheumatoid arthritis due to the presence of para-erosional new bone formation and deep, resorbed, remodeled pits within the capsule areas. Beyond the diagnosis of spondyloarthropathy, the pattern of joint involvement suggests the presence of Reiter's Syndrome in this individual. This diagnosis supports the widening body of evidence that spondyloarthropathy was present in pre-Columbian populations of Indiana.

The phylogenetic relationships of recently described early hominid species. F.E. GRINE, Depts. of Anthropology and Anatomical Sciences, SUNY at Stony Brook, NY 11794, and D.S. STRAIT, Dept. of Anthropology, The George Washington University, 2110 G St. NW, Washington, DC 20052.

Recent years have seen the discovery of four new early hominid species, *Ardipithecus ramidus*, *Australopithecus anamensis*, *Australopithecus bahrelghazali* and *Australopithecus garhi*. Descriptions of these species have been accompanied by hypotheses about their phylogenetic relationships. It has been suggested that 1) *A. ramidus* lies near the ancestry of later hominids, 2) *A. anamensis* may be ancestral to *Praeanthropus africanus*, and is more closely related to later hominids than is *A. ramidus*, 3) *A. garhi* might be ancestral to *Homo*, and 4) *A. bahrelghazali* represents a clade distinct from that of other australopithecines younger than 4 mya, and may figure in the ancestry of *Homo*.

These hypotheses were tested using cladistic analysis. The data set of Strait *et al.* (1997) was updated to include the new species, as well as new characters identified as a result of the descriptions of those species. In addition, the morphoclines of a few characters in the original data set were modified to reflect other recent fossil discoveries and character analyses. Most characters were considered ordered, and all were considered reversible. Taxa with variable morphologies were assigned intermediate character states. Two parsimony analyses were performed. These differed only in that the poorly represented *A. bahrelghazali* was excluded from one analysis. Outgroup taxa and other ingroup taxa were as in Strait *et al.* (1997).

In both analyses, *A. ramidus* and *A. anamensis* branched off near the base of the hominid cladogram, although the exact branching pattern was unclear due to the existence of equally parsimonious solutions. *A. garhi* was the sister taxon of a clade that included *A. africanus*, *Paranthropus* and *Homo*. The relationships of *A. bahrelghazali* could not be adequately resolved. Results are consistent with hypotheses in which *A. ramidus* and *A. anamensis* are sister taxa of, or ancestral to, later hominids. Hypotheses in which *A. garhi* is ancestral to *Homo* should be rejected.

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Molecular evolution of aerobic energy metabolism in primates. L.I. GROSSMAN, M. GOODMAN, T.R. SCHMIDT and W. WU, Center for Molecular Medicine & Genetics and Anatomy & Cell Biology, Wayne State University School of Medicine, Detroit, MI 48201.

Selected adaptive changes in the biochemical machinery for aerobic energy metabolism were among important molecular changes in humankind's evolutionary history. A likely evolutionary pressure for adaptive changes in energy metabolism was the emergence in the anthropoid primates of a larger neocortex, one of the most aerobic and energy consuming tissues. This evolutionary pressure may have been in part responsible for the course of evolution of cytochrome c oxidase subunit IV in anthropoid primates. Cytochrome c oxidase (COX) is the multisubunit enzyme complex that catalyzes the final step of electron transfer through the respiratory chain. Thus, COX plays a vital role

in aerobic energy metabolism. Phylogenetic analysis of rodent, cow, and primate gene sequences that encode COX IV revealed an accelerated nonsynonymous rate in the earlier evolution of catarrhines followed later by a decelerated rate. Pronounced positive selection for adaptive amino acid replacements was evident by higher nonsynonymous (N) than synonymous (S) rates in the lineage encompassing catarrhine and hominid stems. A marked deceleration of N rates with much lower N than S rates in the terminal lineages to gorilla, human, and chimpanzee COX4 genes indicated that the positively selected changes were then preserved by purifying selection. Phylogenetic analyses of gene sequence data for other COX subunits, as well as for other proteins active in the respiratory chain, have also provided evidence for positively selected changes in our earlier anthropoid ancestors.

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Charles Oxnard and the Aye-aye: Morphometrics, cladistics and two very special primates. C. P. GROVES, Department of Anthropology, Australian National University.

Nearly twenty years ago a paper by Oxnard (1981) showed that morphometric analyses of the aye-aye (*Daubentonia madagascariensis*), focusing on a number of different regions of the postcranial skeleton as well as total body proportions, always produced extremely large separations between the aye-aye and other strepsirrhines. On the assumption that morphometric distance is not unrelated to taxonomic distance, the conclusion was drawn that the aye-aye was "Prosimii, perhaps Lemuriformes, *incertae sedis*".

Oxnard was criticized for this presumed phenetic attitude to taxonomy; at that time it was almost axiomatic that *Daubentonia* was related to the Indridae. Subsequent work has shown that *Daubentonia* is in fact the sister-group to all other Malagasy lemurs, and is almost (or quite?) as divergent as are the Loriformes. It thus appears that Oxnard (1981) was describing a phenomenon with real implications for phylogeny, and this in turn raises questions of whether morphometrics at higher taxonomic levels might be pointing towards a genuine phylogenetic signal.

Oxnard, C.E. 1981. The uniqueness of *Daubentonia*. *Amer. J. Phys. Anthropol.* 54:1-21.

Effects of variation in crural index on the kinematics and kinetics of human walking. L.T. GRUSS and D. SCHMITT, Dept. of Biological Anthropology and Anatomy, Duke University, Durham, NC. 27710

Variation in crural index, (tibia length/femur length), has been studied extensively in both modern and fossil hominids. High crural indices have been attributed to fossil hominids,



notably *Homo ergaster* and Upper Paleolithic European *Homo sapiens*. In modern humans, high crural indices (i.e. a relatively long tibia) have been shown to facilitate greater dissipation of heat and improve locomotor energy efficiency. However, the effects of greater relative tibial length on bone and joint stresses have never been investigated.

This study investigates the hypothesis that, all else being equal, high crural indices should induce higher bending moments along the tibia and at the knee during the support phase of walking. This proposition is based on the fact that if ground reaction forces remain equal regardless of tibia length, subjects with relatively long tibiae will experience higher moment arms of the ground reaction resultant force (GRR) at any homologous point along the leg compared to those with relatively short tibiae. Unless people with higher crural indices modify their gait in such a way as to decrease these moments they must maintain osteological stabilization mechanisms to resist the increased bone stresses. To test this hypothesis, we obtained kinematic and kinetic data, using simultaneous video and force plate recordings, on 15 maximum-speed steps for 15 human subjects in the Vertebrate Movement Laboratory at Duke University. Joint position and ground reaction force data was taken throughout stance phase.

We found significant positive correlation between crural index and the moment arm and moment of the GRR at the knee during the second half of support phase. Differences in the angle of the tibia relative to the ground align the limb more closely with the GRR in persons with high crural indices in the early part of support phase but not in the latter half.

These findings imply that both modern and fossil hominids with high crural indices, while possibly experiencing thermoregulatory benefits and improved locomotor energy efficiency, must also have experienced relatively high bone and joint stresses along the leg. The results have important implications for understanding lower limb morphology in early members of the genus *Homo*.

Interpreting sex difference in linear enamel hypoplasia in non-human primates. D. GUATELLI-STEINBERG, University of Oregon, Eugene, OR 97403 and E.A. NEWELL, Elizabethtown College, Elizabethtown, PA 17022

This study investigates non-human primate sex differences in the expression of linear enamel hypoplasia (LEH), a retrospective indicator of physiological stress. The study is divided into two parts, the first of which (conducted by Newell) examines sex differences in LEH prevalence across the primate order (N=2646). The second part (conducted by Guatelli-Steinberg) examines sex differences in defect counts, a measure of the number of stress events recorded during an individual's period of enamel formation, in great apes (N=27) and gibbons (N=34).

Newell scored individuals as affected by LEH if any one tooth in an individual's permanent dentition exhibited a linear or groove defect. Only unworn teeth or teeth with minimal wear were included. Guatelli-Steinberg scored defect counts on unworn or minimally worn mandibular canines. The defect count is defined as the number of matched lines or grooves on the canine antimeric pair.

Newell's results are as follows. Across the primate order, LEH is significantly more prevalent in males than

females ( $p < 0.0001$ ). Anthropoid males and platyrrhine males have significantly more LEH than their female counterparts. The sex difference in LEH prevalence for catarrhines was not significant. Within hominoids, orangutans show significant sex differences in LEH prevalence while gibbons, gorillas and chimpanzees do not. Guatelli-Steinberg finds that differences in defect counts are not significant for gibbons but are significant for the combined great ape sample ( $p < 0.0001$ ). Great ape males are 5.78 times more likely than females to have higher defect counts on their mandibular canines.

These data appear to reflect the combined effects of two factors, the first of which is a potential greater male vulnerability to stress (as suggested by sex differences in prevalence). The second factor is the extended period of canine crown formation in great ape males relative to females, affording greater opportunity to record multiple stress events (as suggested by sex differences in defect counts).

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New specimens of *Copelemur* (Notharctidae, Primates) from the Wasatch Formation (Early Eocene), southwestern Wyoming: Implications for North American adapiform diversity. G.F. GUNNELL, Museum of Paleontology, University of Michigan, Ann Arbor, MI 48109, E.R. MILLER, Department of Anthropology, University of North Carolina, Chapel Hill, NC 27599, and K.M. MULDOON, Department of Anthropology, University of Toronto, Toronto, ON, Canada.

Recent fieldwork in the Wasatch Formation near Fossil Butte National Monument in southwestern Wyoming has produced the best specimens yet available from the holotype locality of the relatively rare notharctine primate *Copelemur australotutus*. When originally described (Beard, 1988) *C. australotutus* was represented by a single eroded dentary fragment with P/3-M/1 and a questionably referred lower molar. The new material includes several well preserved lower dentitions and the first known upper teeth of this species. Upper molars differ from those of *C. tutus* in lacking a distinct mesostyle and in having more crenulate enamel. *C. australotutus* also differs from *C. tutus* in lacking a deep M/3 hypoflexid but resembles *C. tutus* in having well developed entocristids in contrast to *C. praetutus*.

These new *Copelemur* specimens along with specimens from other areas in southern Wyoming (Cuozzo and Covert 1999) necessitate a re-evaluation of the diversity and geographic distribution of copelemurin notharctids. It has been suggested that Wasatchian (early Eocene) notharctid diversity was higher in the southern parts of the United States (e.g. New Mexico) than it was in more northerly regions (Gingerich and Haskin, 1981; Beard, 1988) and thus that notharctids may have had a southern origin (Froehlich and Lucas, 1991). Among copelemurins there are now three species of *Copelemur* represented in the early Eocene of Wyoming that together span the entire Wasatchian.

chian (*C. praetutus*, *C. australotutus*, and *C. tutus*) while only *C. tutus* and the enigmatic ?*Smilodectes gingerichi* are known from the New Mexican middle Wasatchian. Both specific diversity and temporal range of coplemurins (and notharctins as well) are greater in Wyoming than New Mexico casting doubt on the southern origin hypothesis.

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Sociality in a nocturnal primate? S. L. GURSKY,  
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Over the last two decades, increasingly detailed studies have shown that many prosimian primate species reside in large groups at their sleeping site where various forms of social behavior are exhibited. These observations have resulted in a re-phrasing or re-classification of the nocturnal prosimians as solitary foragers. However, the classification of, or reference to, the nocturnal prosimians as solitary foragers is questionable given the fact that many of these species have also been observed in small groups during nightly foraging. For example, during Charles-Dominique's (1977) synecological study of several African nocturnal prosimians, in 25% of his observations (n=263) of *Galago demidovii*, groups of 2-5 individuals were observed.

The primary goal of this study was to quantitatively test the hypothesis that spectral tarsiers are gregarious foragers and that encounters between group members are not the result of chance. Data were collected in Tangkoko Nature Reserve, Sulawesi, Indonesia from July 1999-November 1999. Full night simultaneous focal follows were conducted on three male-female pairs. Locational and behavioral data were recorded during focal follows. To test if the encounters between group members were random chance encounters or whether group members actively sought one another out, or actively avoided one another, Waser's (1981) random gas model used.

The results from this study indicate that spectral tarsiers are not solitary forager, but are gregarious foragers. Spectral tarsiers spent substantial portions of foraging time in proximity to one another, encounters between group members were not the result of chance encounters, nor did group members actively avoid one another. Several possible explanations for the gregarious foraging behavior exhibited by the spectral tarsiers will be discussed.

PRISON Records: Another Source of Anthropometric Data  
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Height has long been used as a means of identification and more recently as an indicator of socioeconomic conditions. This study

compares the heights of 960 white males convicted of a variety of crimes in Erie County, N.Y. between 1896 and 1905.

The men range in age from 16 to 72 years. 639 were born in the U.S., 321 were foreign born. The sample was divided into two groups: those 21 years and younger and those over the age of 21. Analysis shows that foreign born adolescents reached mature height about one year later than native born adolescents. Foreign born are shorter than native born in this group except for 19 year olds whose heights are virtually identical.

The heights of those over 21 years were analyzed in 5 year birth cohorts as well as 5 year age cohorts. Except for the years 1845 - 1849, native born males are taller than foreign born males. There was a dramatic decline in height in both groups between 1835 and 1839. Heights recovered over the succeeding decades until another decline began in 1875. A pattern of decrease in heights has been documented at the end of the 19th century in other samples (Steckel & Haurin, 1994).

Comparison of the average heights of men in this sample with the heights of military recruits in the 18th and 19th centuries shows that the heights of this sample are on average 2 - 5 cm. less. This suggests that military height data may not be representative of all segments of American society in the 19th century.

The Upper Paleolithic children of Russia: comparative dental anthropological analysis of the permanent teeth.  
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The remains of two children from Sungir, two from Kostenki in European Russia, one from Mal'ta in central Siberian Russia — some found with artfully crafted grave goods that included mammoth-tusk artifacts — comprise the known subadults of the "mammoth hunters" of Upper Paleolithic Russia. Subadult teeth have also been found in an Altai Mountain Cave and at Ushki, Level VI, Kamchatka.

Comparative dental morphological trait analysis of the permanent teeth of the Sungir, Kostenki, and Mal'ta children indicates that they were likely members of a single biological group as well as a common culture. Dental traits of the permanent teeth and archaeological evidence further indicate that, although they died prior to adulthood, the children of Sungir, Kostenki, and Mal'ta were likely members of the ancestral lineage of post-glacial European Russia (Oleneostrovski' Mogil'nik) and Ukraine (Vasil'evka I and III, Voloshskoe). In contrast, neither the central Siberian Russian Mal'ta nor the Upper Paleolithic European Russian subadults were dentally similar to the next oldest Siberians, Neolithic Kitoi people, or to New World Paleo-Indians, most of whom post-dated them.

The Altai Mountain subadult teeth seem to be like those of Neanderthals. Ushki teeth are in a

developmental stage that we do not understand.

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Parent and child health in a Yanomamö village. E.H. HAGEN<sup>1</sup>, R.B. HAMES<sup>2</sup>, N.M. CRAIG<sup>1</sup>, M.T. LAUER<sup>1</sup>, M.E. PRICE<sup>1</sup>. <sup>1</sup>Department of Anthropology, University of California, Santa Barbara, CA 93106. <sup>2</sup>Department of Anthropology, University of Nebraska-Lincoln.

The 1998 El Niño significantly reduced garden productivity in the Upper Orinoco region in Venezuela. Consequently, mothers were forced to carefully allocate food to their children. Nutrition data collected from village children combined with genealogical data and garden productivity data allowed us to determine which families produced the most, which children suffered the most, and whether the patterns of food distribution accorded with predictions from parental investment theory.

For boys, three social variables accounted for over 70% of the variance in subcutaneous fat: number of siblings, age of the mother's youngest child, and whether the mother was the senior or junior co-wife in a polygynous household, or was married monogamously. These results accord well with parental investment theory. Mothers experiencing food scarcity faced a tradeoff between the quantity and quality of offspring, and between investing in younger vs. older offspring. In addition, boys with access to more paternal investment (i.e., no stepmother) were better nourished. These variables did not account for any of the variance in female nutrition. Girls' nutrition was associated with the size of their patrilineage and the number of non-relatives in the village, suggesting that lineage politics may have played a role.

Parent death had no discernable effect on child nutrition, but had a large effect on child parasite load. Orphans did not differ significantly from other children in levels of subcutaneous fat, but suffered high rates of severe infection by the ectoparasite *Tunga penetrans* (sand fleas). The large number of orphans being cared for by only two grandparents suggests that grooming time may have been the resource in short supply.

This study highlights a number of factors, including mothers' pregnancy, lactation, and death, that can impose significant energetic and health costs on children, results that may have implications for interpreting sex and age differences in the nutrition and health of small scale historic and prehistoric populations.

A Newly Discovered Early Pliocene Hominid Bearing Paleontological Site in the Mulu Basin, Ethiopia. Y. HAILE-SELASSIE, Department of Integrative Biology and Laboratory for Human Evolutionary Studies, University of California at Berkeley, Berkeley, CA 94720 and B. ASFAW, Rift Valley Research Services, P.O.Box 5717, Addis Ababa, Ethiopia.

The Mulu basin is located in the central Afar rift, southwest of Mount Ayelu and east of the Assab-Addis Ababa paved road, ca. 10 km east of "Gedamaitu" town. Satellite imagery coupled with a brief air survey to the area in 1991 identified its potential. Foot surveys conducted in 1997 and 1998 demonstrated that the sediments were fossiliferous. The fluvial and lacustrine sediments are exposed over a wide area and include volcanics. The Mulu Basin, especially the area locally known as "Galili," is highly fossiliferous and contains diverse taxa. This new paleontological area samples a critical time period barely known in other parts of Africa. The minimum age of the deposits has been radiometrically determined to be 3.4 Ma based on a basalt that caps the entire sequence. However, the underlying vertebrate fauna, including primitive anancines, suggests a biochronological age older than 4 Ma for the fossiliferous horizons.

During the first two short surveys, fossil specimens representing different taxa were collected. The recovered fauna includes primates, carnivores, bovids, proboscideans, equids, and suids. Aquatic fauna, such as crocodiles, hippopotamids, and fishes are also abundant. Among the primate remains are three hominid teeth. Preliminary analysis of these teeth shows that they belong to a species more primitive than *Australopithecus afarensis* and more like *Australopithecus anamensis*. Additional hominid recoveries may elucidate the relationship between *A. anamensis*, *A. afarensis* and the earlier hominid *Ardipithecus ramidus*.

Almshouse Demography during the Nineteenth Century. M. HAINES, Department of Economics, Colgate University, Hamilton, NY 13346 and R.L. HIGGINS, Department of Health Sciences, Cleveland State University, Cleveland, OH 44115-2407.

A combination of skeletal data and Federal Census data are used to describe the demography of six almshouses during the nineteenth century including Monroe County, NY, Broome County, NY, Albany County, NY, Cook County, IL, Milwaukee County, WI and Uxbridge, MA.

Name, age, sex, race, place of birth, and occupation are listed for almshouse inmates in the federal censuses of 1850, 60 and 70. In later years marital status, duration of current marriage, children ever born, children surviving and industry are also listed. These variables are combined with

both skeletal data and, where available, other archival sources. Results listed below describe demographic patterns for the Monroe County Almshouse during the 1850's and are an example of the results obtained from analyzing these data.

In 1850, 36% of the inmates were under 14 years of age. Sixty six per cent of the population was foreign born compared to 44% in the city of Rochester. The death records by age and sex (from the Brighton Town Clerk's Records) were related to the tabulations from the 1850 Federal Census. Nineteen per cent of the average population died in any given year (this represents a crude death rate of 193). For those over age 60, 51% died and for those under age 5, 38% died in any given year. The skeletal pathologies observed in this sample indicate that inmates suffered from chronic infectious diseases and nutritional deficiencies.

These data indicate that this institution was a pesthouse where inmates (mostly immigrants) entered because they were ill and died there. It was also a focus for infection where many otherwise healthy inmates contracted infectious diseases and subsequently died.

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**Intra-population variation in nasal morphology.** R.L. HALL, Department of Anthropology, Oregon State University, Corvallis, Oregon 97331-6403.

Nasal morphology constitutes a crucial system of climatic adaptation in human populations. Researchers have focused on central tendencies in size and shape of the nasal bridge and aperture and on differences that exist between populations. Within-population variation is equally important, however, because natural selection works upon such variation if climates change or if populations move. Intra-population variation also provides important information for forensic identifications; the relative frequency of both typical and atypical features needs to be appraised.

This paper, which is part of a large study of geographic variation in nasal morphology, uses both metric and non-metric traits to analyze and portray the range of variation within samples of 12 local populations, each drawn from a single cemetery or adjacent cemeteries representing a single community. Each sample consists of between 11 and 32 adult male and female skulls.

Two non-metric traits (nasal saddle form and infraglabellar notch profile) and 7 metric traits (the chord from nasion to the lower extremity of the nasal bones; the distance between the nasal-maxillary sutures

at their inferior edge; nasal height; nasal breadth; nasal index; the simotic chord; and the simotic subtense) are used. Though modal differences between populations, notably those from different continents and climates, are clear, measures of intra-population variation show considerable overlap between groups. Implications for forensic identification and for evolutionary adaptation are discussed.

I acknowledge with gratitude the use of skeletal collections from the American Museum of Natural History, the University of Oregon Museum of Natural History, the San Diego Museum of Man, and the Smithsonian Institution.

**A Y-chromosome perspective on the Jomonese component of the contemporary Japanese gene pool.** M. F. HAMMER<sup>1</sup>, S. HORAI<sup>2</sup>, W. KIM<sup>3</sup>, K. OMOTO<sup>4</sup>, M. STONEKING<sup>5</sup>, H. PARK<sup>1</sup>, and T. KARAFET<sup>1</sup>, 1 University of Arizona, Tucson, AZ 85721, 2 National Institute of Genetics, Mishima, Japan, 3 Dankook University, Choong Nam, Korea, 4 International Research Center for Japanese Studies, Kyoto, Japan, 5 Pennsylvania State University, University Park, PA 16802.

Haplotypes constructed from Y-chromosome markers were used to trace the origins of Japanese populations. Our global sample consisted of >2000 males from 40 populations, including 6 Japanese and 34 Asian/Pacific groups. A set of 18 biallelic polymorphisms gave rise to 19 Y-chromosome haplogroups, 14 of which were present in our Asian samples. We also examined multiallelic variation associated with six Y-linked microsatellites (Y-STRs). Japanese populations were characterized by the presence of 10 Y-haplogroups, six of which were relatively common (3G, 1U, 1J, 1M, 1Fa and 1Fb). We suggest that the contrasting distribution patterns are the result of separate and distinct genetic contributions of both the Jomon People and the Yayoi to contemporary Japanese populations. Furthermore, we estimated the age of a Japanese-specific lineage based on the variance in STR repeat numbers associated with the 1Fb haplogroup. Finally, we traced the origins of ancestral Jomonese paternal lineages through surveys of haplogroup 3G in Asian populations. Our findings are consistent with the hypothesis of a Central Asian origin of the ancestors of the Jomonese. We are testing this hypothesis through continued surveys of other candidate founding haplogroups and their associated Y-STR alleles.

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